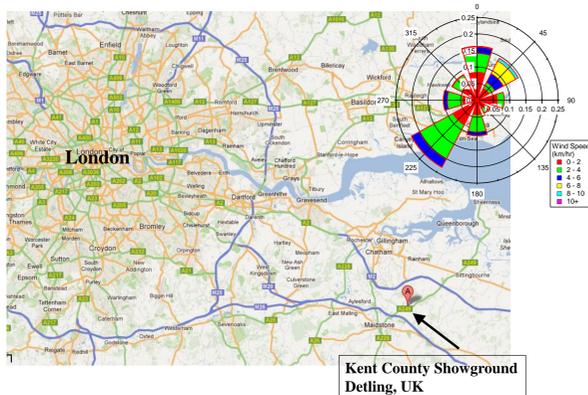


Overview of ClearLo: Study of Aerosol Sources and Processing at a Rural Site Southeast of London, January-February, 2012

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Clean Air for London (ClearLo) Winter Intensive Detling Site (Jan-Feb 2012)



- Study of London air pollution at an urban street site, an urban background site and rural sites in order to understand transport and aging of the urban plume.
- We provided an extensive suite of instruments at the rural site SE of London in Detling, UK.
- During the one month deployment, we sampled London outflow, continental outflow and local pollution sources.
- Goals are to:
 - Understand air mass sources and aging, and correlations with London urban measurements.
 - Provide closure between optical properties and chemical composition, including black carbon.
 - Measure absorption enhancement by coatings on black carbon.

Instruments at Detling:

Gas-Phase Measurements:

- NO, NO₂, NO_x, O₃, N₂O, CO₂, CO, NH₃, HCHO
- PTR-MS and GC/FID: VOC's
- MOVI-CI-ToF (oxygenated HC's)

Particle Measurements:

- HR-ToF-AMS, SP-AMS
- MOVI-CI-ToF (organic acids)
- SMPS, LAS
- Thermal Denuder

Particle Black Carbon:

- SP-AMS, MAAP, SP2, aethalometer

Particle Optical Measurements:

- CAPS PMex (red and blue), PASS-3

Bulk Particle Measurements:

High volume filter sampler, rotating drum impactor, SEM filter collector

Remote Sensing:

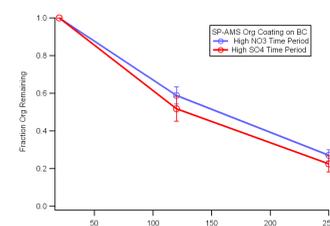
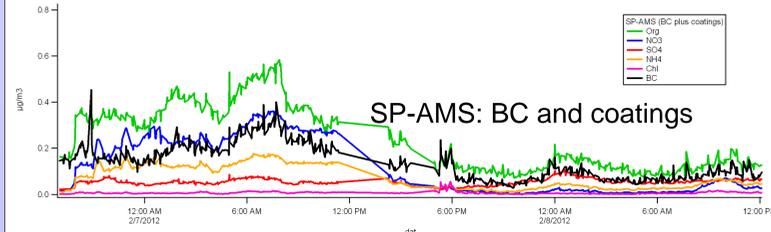
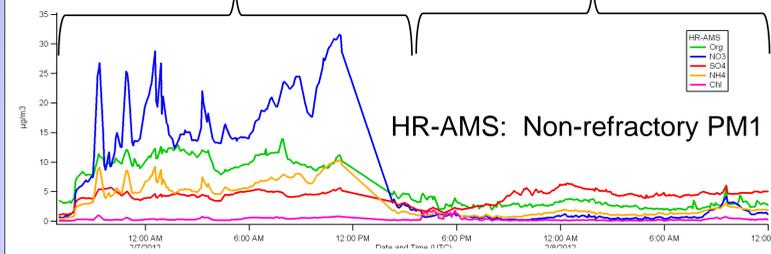
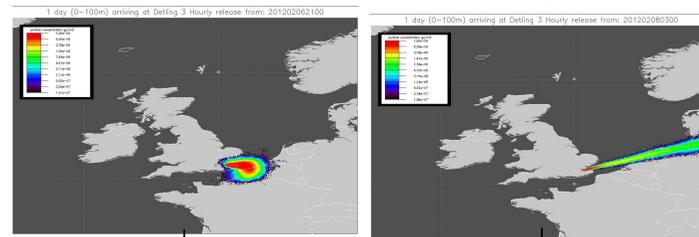
- Micro Pulse LIDAR
- Radiometer
- SODAR Wind Profiler
- Surface met

Acknowledgements:

- US DoE Atmospheric System Research Program
- UK Natural Environment Research Council

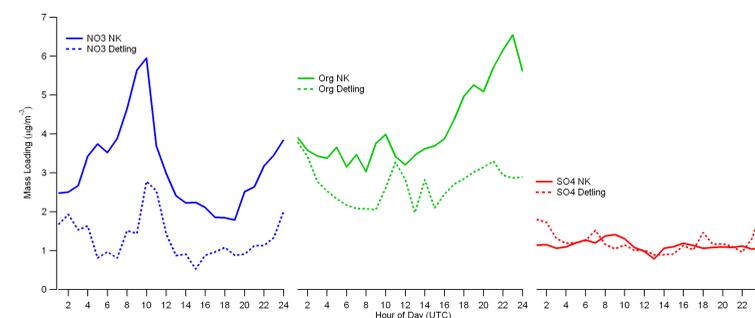
Regional PM Sources

- Time period with high OOA (Oxygenated Organic Aerosol) and sudden shift from high NO₃ to high SO₄.
- UK Met. Office NAME 24 hour back trajectories indicate source regions are quite different (Zoe Fleming, U. Leicester)



Volatility of organic coatings on BC measured by passing particles through a thermal denuder. OA associated with high SO₄ slightly more volatile than OA associated with high NO₃.

Urban Increment

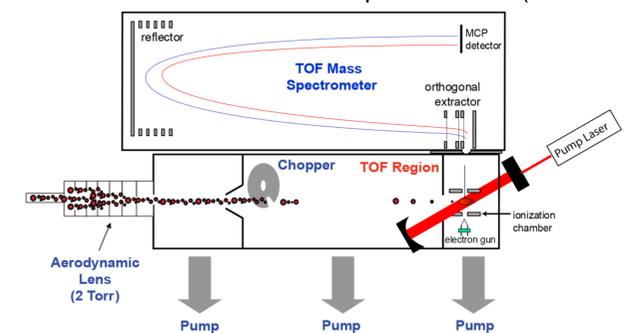


Comparison of non-refractory PM1 in North Kensington, London (NK) and at rural site (Detling) measured with AMS. Nitrate and organics are higher at NK due to urban increment in local emissions. Sulfate is similar because regional source.

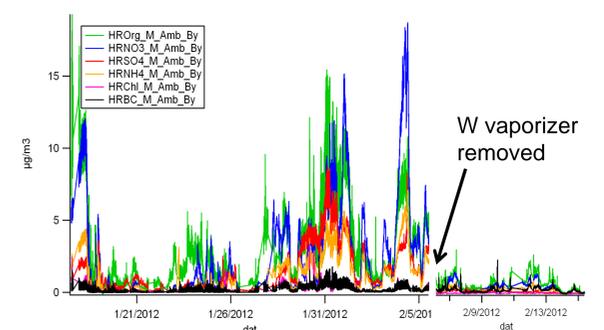
Black Carbon Sources

- Use chemical composition of coatings on BC particles to identify sources

Soot Particle – Aerosol Mass Spectrometer (SP-AMS)

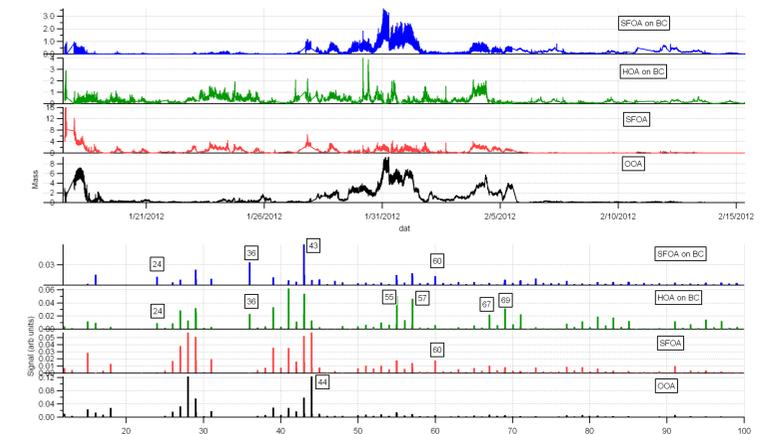


Combines DMT SP2 and ARI HR-AMS



Campaign overview of SP-AMS data

- 17 Jan to 5 Feb: Both vaporizers, switching laser on/off, measures all non-refractory PM1 plus BC
- 5 Feb to 15 Feb: Laser vaporizer only measures BC containing particles only plus coatings



Positive Matrix Factorization of Organics plus BC gives 4 factors, two with BC (Solid Fuel Organic Aerosol on BC and Hydrocarbon-like Organic Aerosol on BC) and two without BC (Solid Fuel Organic Aerosol and Oxygenated Organic Aerosol). The second two factors decrease when the tungsten thermal vaporizer is removed.